

November 2, 2000

SVP-00-159

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20555

Quad Cities Nuclear Power Station, Units 1 and 2  
Facility Operating License Nos. DPR-29 and DPR-30  
NRC Docket Nos. 50-254 and 50-265

Subject: Supplemental Report Concerning Reactor Trip due to a Main Generator  
Differential Relay Operation

Enclosed is Licensee Event Report (LER) 265/00-008, Revision 01, for Quad Cities Nuclear Power Station.

This report is submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(iv). The licensee shall report any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature.

We are committing to the following actions:

The neutral current transformer (CT) for the Unit 1 Main Power Transformer (MPT) will be replaced to meet the design requirements of the polarizing circuit.

Twelve CTs will be replaced on the bus tie breaker to minimize CT mismatch with the existing Westinghouse CTs.

A high range ground directional relay scheme will be designed and installed.

The reclosing requirements for 345kV Line 0405 will be reviewed and revised as necessary.

Current design change practices for CT and CT circuits will be evaluated and necessary process changes will be implemented to ensure future design changes in the switchyard are properly reviewed and implemented.

The remaining components of the existing differential circuit that could not be tested online will be inspected to ensure that common components used in the new relay scheme are adequate for future use.

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The existing generator differential relay scheme will be replaced to increase the operating margin for external faults. Design enhancements will be made to the generator differential protection for Quad Cities Unit 2 that lessen the susceptibility for tripping as a result of external faults on the transmission system.

Any other actions described in the submittal represent intended or planned actions by Commonwealth Edison (ComEd) Company. They are described for the NRC's information and are not regulatory commitments.

Should you have any questions concerning this letter, please contact Mr. C.C. Peterson at (309) 654-2241, extension 3609.

Respectfully,

A handwritten signature in cursive script, appearing to read "Joel P. Dimmette, Jr.", followed by a small mark that looks like a stylized "for" or a flourish.

Joel P. Dimmette, Jr.  
Site Vice President  
Quad Cities Nuclear Power Station

cc: Regional Administrator – NRC Region III  
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

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bcc: Project Manager – NRR  
Office of Nuclear Facility Safety, - IDNS  
Senior Reactor Analyst – IDNS  
Resident Inspector - IDNS  
Manager of Energy Practice – Winston and Strawn  
Director, Licensing and Compliance – ComEd  
Vice President, Regulatory Services– ComEd  
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W. Leech – MidAmerican Energy Company  
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Regulatory Assurance Manager – Dresden Nuclear Power Station  
Regulatory Assurance Manager – Quad Cities Nuclear Power Station  
NRC Coordinator – Quad Cities Nuclear Power Station  
NSRB Site Coordinator – Quad Cities Nuclear Power Station  
Site Vice President – Quad Cities Nuclear Power Station  
Station Manager – Quad Cities Nuclear Power Station  
SVP Letter File

## LICENSEE EVENT REPORT (LER)

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Information and Records Management Branch (4-6 f33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office Of Management And Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FACILITY NAME (1)

Quad Cities Nuclear Power Station, Unit 2

DOCKET NUMBER (2)

05000265

PAGE (3)

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TITLE (4)

Reactor Trip Due to a Main Generator Differential Relay Operation

LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
2000	008	01	11	02	2000	Quad Cities Nuclear Power Station, Unit 1	05000254
2000	008	01	11	02	2000	N/A	05000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5 (Check one or more) (11)					
POWER LEVEL (10)	100	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)		
		20.2203(a)(i)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)		
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71		
		20.2203(a)(2)(ii)	20.2203(a)(4)	X	50.73(a)(2)(iv)	OTHER	
		20.2203(a)(2)(iii)	50.36(c)(1)		50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 388A	
		20.2203(a)(2)(iv)	50.36(c)(2)		50.73(a)(2)(vii)		

## LICENSEE CONTACT FOR THIS LER (12)

NAME Charles Peterson, Regulatory Assurance Manager	TELEPHONE NUMBER (Include Area Code) (309) 654-2241 ext 3609
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## COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

## SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i. e., approximately 15 single-spaced typewritten lines) (16)

At 0548 hours on July 18, 2000, Unit 2 automatically scrambled from full load due to a C-phase generator differential relay operation. The Unit 2 trip was concurrent with an insulator fault on the C-phase of a 345kV line. Equipment on Unit 2 responded to the scram as expected to shut the unit down.

Approximately ten seconds after the Unit 2 scram an attempted automatic reclosure of a 345kV breaker in the switchyard caused a 345kV differential relay to operate. The result of this was a loss of power to the Reserve Auxiliary Transformer (RAT), which provides normal offsite power to one division of Unit 1. The loads normally supplied by the RAT automatically transferred to the Unit Auxiliary Transformer (UAT), which normally provides power from the Unit 1 generator to one division of Unit 1. Unit 1 continued to operate for about ten hours with power supplied to both Unit 1 divisions by the UAT, after which the RAT was reenergized and the loads transferred back.

The root causes of this event included current transformer mismatch, an inappropriate breaker reclose scheme, and inadequate consideration of CT mismatch during implementation of distribution yard design changes.

The safety significance of this event was minimal. On Unit 2, all control rods inserted, and reactor water level and pressure were controlled using the normal coolant supply and heat removal systems. On Unit 1, the UAT supplied power during the event, with offsite power available from the Unit 2 RAT, as designed.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

**PLANT AND SYSTEM IDENTIFICATION:**

General Electric - Boiling Water Reactor - 2511 MWt rated core thermal power  
Energy Industry Identification System (EIIIS) Codes are identified in the text as [XX] and are obtained from IEEE Standard 805-1984, IEEE Recommended Practice for System Identification in Nuclear Power Plants and Related Facilities.

**EVENT IDENTIFICATION:**

Reactor Trip Due to a Main Generator Differential Relay Operation

**A. PLANT CONDITIONS PRIOR TO EVENT:**

Units: 1 and 2                      Event Date: July 18, 2000                      Event Time: 0548  
Reactor Mode: 1 (Unit 1 and 2)                      Mode Name: Power Operation                      Power Level: 100 (Unit 1 and 2)

Power Operation (1) - Mode switch in the RUN position with average reactor coolant temperature at any temperature.

**B. DESCRIPTION OF EVENT:**

At 0548 hours on July 18, 2000, Unit 2 automatically scrammed from full load due to a C-phase generator [GEN] [TB] differential relay [87] operation. The trip was concurrent with an insulator fault about five miles from Quad Cities Nuclear Power Station on the C phase of a 345kV line (Line 0405) that is connected to the station. Equipment on Unit 2 responded as expected to shut the unit down.

Immediately after the Unit 2 scram, the Unit 1 Reserve Auxiliary Transformer [XFMR] (RAT), which normally provides offsite power to one division of the Unit 1 emergency and balance-of-plant busses [BU], tripped. One of the 345kV breakers that had tripped to isolate Line 0405 attempted an automatic reclosure in accordance with the design. This caused a ground directional relay to actuate, isolating the bus feeding the RAT. The loads supplied by the RAT transferred to the Unit Auxiliary Transformer (UAT), which normally provides power from the Unit 1 generator to the other division of the Unit 1 emergency and balance-of-plant busses. This placed Unit 1 in a seven-day Technical Specification allowed outage time. At 1456 hours the Unit 1 RAT was reenergized and at 1529 hours the loads normally supplied by the Unit 1 RAT were transferred back to the normal supply.

**C. CAUSE OF EVENT:**

The root cause of the Unit 2 trip is:

- Insufficient margin resulting from current transformer (CT) circuit mismatch under fault conditions. CTs have been added and replaced due to changes at the station over the years. This has resulted in a mismatch of the CT circuit under fault conditions, which challenged the operating margin of the generator differential relay.

The root causes of the trip of the Unit 1 RAT are:

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- Insufficient margin resulting from CT circuit mismatch under fault conditions. The CTs for the bus ties associated with the bus feeding the Unit 1 RAT have different manufacturers and ratings, which causes a mismatch in CT saturation and a resultant current flow in the ground directional relay operating coil.
- The Unit 1 CT input to the polarizing circuit was not in accordance with the design requirements of the circuit. The neutral CT on the Unit 1 Main Power Transformer (MPT), which feeds the polarizing circuit of the ground differential relay, did not have the correct rating, causing it to saturate. This caused the directionality of the relay to provide input to the ground differential relay circuit.
- The existing design, which involves an automatic attempt at reclosure to a deenergized line, caused a transient on the yard ring bus resulting in a mis-operation of the ground differential relay. It is not typical to have the initial reclosure to a dead line occur automatically at a generating station.

The overall root cause producing the above issues is:

- Inadequate consideration of CT mismatch during implementation of distribution yard design changes.

**D. SAFETY ANALYSIS**

The safety significance of the Unit 2 scram was minimal. All control rods inserted, and reactor water level and pressure were controlled using the normal coolant supply and heat removal systems.

The safety significance of operation of Unit 1 with the RAT tripped was also minimal. The UAT supplied power during the event, with offsite power available throughout the event from the Unit 2 RAT through bus crossties, in accordance with plant design and Technical Specifications.

**E. CORRECTIVE ACTIONS:**

**For Unit 2 Scram, Completed Actions:**

The C Phase differential relay that tripped Unit 2 was disabled (see previous occurrences discussion below). The remaining two phases of the generator differential relay scheme will provide adequate protection for multiphase faults on the 18 KV Bus and the Unit 2 generator.

A temporary Digital Fault Recorder monitoring system has been installed on the generator differential relay current circuits to record future transients on the scheme. It will remain in service until a new relay scheme has been designed and installed.

**For Unit 2 Scram, Actions to be Completed:**

The remaining components of the existing differential circuit that could not be tested online will be inspected to ensure that common components used in the new relay scheme are adequate for future use.

The existing generator differential relay scheme will be replaced to increase the operating margin for external faults. Design enhancements will be made to the generator differential protection for Quad Cities Unit 2 that lessen the susceptibility as a result of tripping as a result of external faults on the transmission system.

**For Unit 1 RAT Trip, Completed Actions:**

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The existing ground directional relays were removed from service on the 345kV bus until the CTs can be replaced. The replacement of these CTs will increase the operating margin for through-faults, permitting the installation of higher range relays. An impedance relay remains in service protecting the 345kV Bus and the RAT.

The automatic reclosure function on 345kV Line 0405 from Quad Cities Station was disabled.

The neutral CT contribution from the Unit MPT to the current polarization circuit was shorted out to ensure no false signals are transmitted to the ground directional relay.

**For Unit 1 RAT Trip, Actions to be Completed:**

The neutral CT for the Unit 1 MPT will be replaced to meet the design requirements of the polarizing circuit.

Twelve CTs will be replaced on the bus tie breaker to minimize CT mismatch with the existing Westinghouse CTs.

A high range ground directional relay scheme will be designed and installed.

The reclosing requirements for 345kV Line 0405 will be reviewed and revised as necessary.

**For the Design Issues, Actions to be Completed:**

Current design change practices for CT and CT circuits will be evaluated and necessary process changes will be implemented to ensure future design changes in the switchyard are properly reviewed and implemented.

**F. PREVIOUS OCCURRENCES:**

LER 265/98-003, "A Unit Two Main Generator Trip and Subsequent Reactor Scram occurred due to a loose electrical connection in a current transformer that was caused by vibration," documented the June, 1998, trip of Unit 2. A differential protective relay on the C phase was found actuated. A loose electrical connection was found in a junction box on a lead off of a CT. This event involved actuation of the same C phase relay as during the July 18, 2000, event. This previous root cause was determined to be inadequate.

**G. COMPONENT FAILURE DATA:**

There were no site component failures associated with this event.